ST. ANTHONY FALLS LABORATORY

UNIVERSITY OF MINNESOTA
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Effect of freshwater mussels on stream bed morphology

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Introduction

Freshwater mussels are good indicators for the overall well-being of aquatic ecosystem because they can live decades, are relatively sedentary, and are filter feeders.

Because they live in the river bed, mussels are inherently tied to flow and sediment transport. During floods mussels can be,

- Buried and unable to resurface
- Dislodged from the sediment
- Anchored in the sediment

Figure 1. *Lampsilis cardium* in sediment of the St. Croix river.

Figure 2. *Amblema plicata* in sediment of the OSL.

Figure 3. *Lasmigona complanata* shell.

Objectives

The overall goal of this project is to understand how freshwater mussels are impacted by sediment bed load, and how mussels affect their habitat during flooding. Specifically, this project asks the question: Do mussels have a measurable effect on stream bed stabilization? This may vary by,

- species
- mussel population density
- sediment loading rate

Outdoor StreamLab

Experimental stream setup capable of full control of water and sediment inflow.

Figure 4. OSL as viewed from above.

Figure 5. Location in OSL of mussel placement.

Methods

Six flooding experiments were run in channel meander for 6 hours with,

- Flow rates of approximately 200 L/s
- Sediment feed rates of 4 kg/min to reach a quasi-equilibrium state
- Max velocities in stream channel reached approximately 65 cm/s

Research question #1:
Compare by mussel density

- Control: no mussels
- Low density, *A. plicata*
- High density, *A. plicata*

Research question #2:
Compare by mussel species

- *Amblema plicata*
- *Lampsilis cardium*
- *Lasmigona complanata*

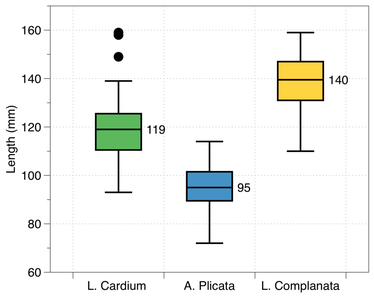


Figure 6. Distribution of mussel lengths

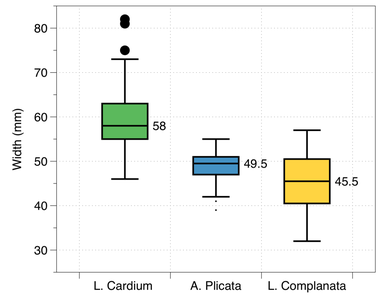


Figure 7. Distribution of mussel widths

Data collection:

A computer controlled instrumentation carriage with an attached sonar probe was used to take repeat scans of the stream channel. Stream bed elevation data was collected to evaluate bedforms and changes in elevation over time.

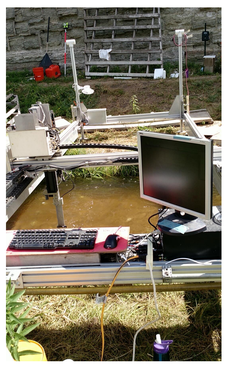
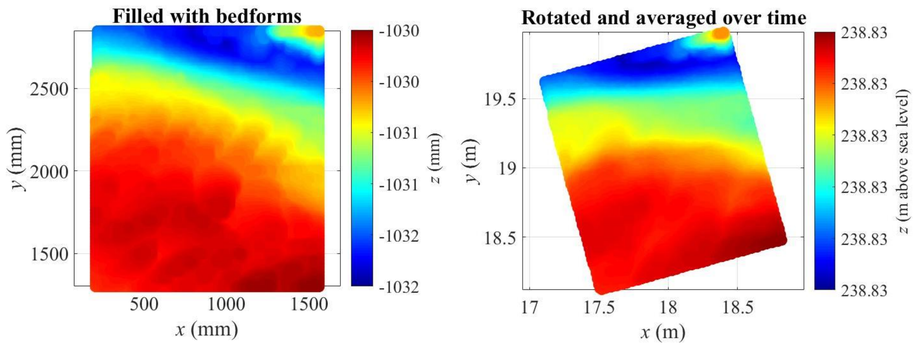


Figure 9. View from the instrumentation cart.

Steps in data analysis:

1. Filter data
2. Convert to OSL coordinates
3. Average 10 repeated scans to reduce the influence of bedforms



Figures 8 & 9. Plots of data, from data analysis step 1 to 3.

Results

Mussel presence appears to have a small effect on stream bed morphology.

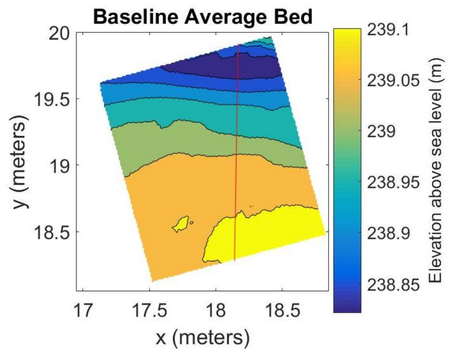


Figure 10. Contour plot of the no mussel flood average bed. Cross section location for figures 11 and 12 indicated with a red line.

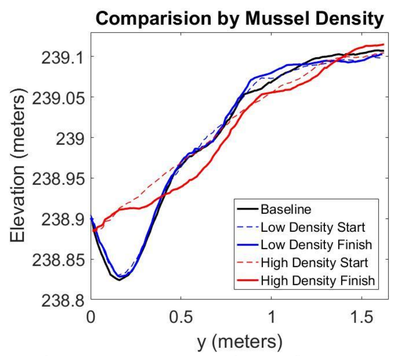


Figure 11. Cross sections of average stream bed for no mussels, low density and high density.

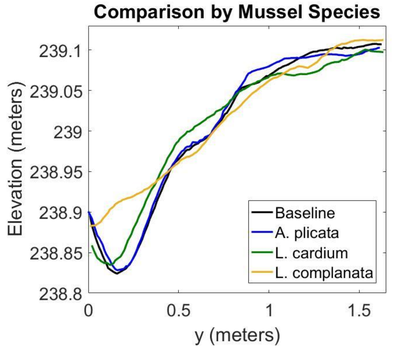


Figure 12. Cross sections of average bed elevation for 3 species of mussels.

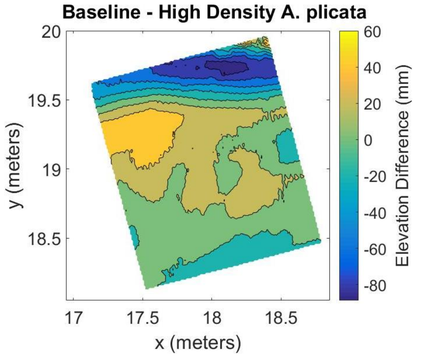


Figure 13. The subtracted difference between baseline (no mussels) and high density of mussels, *A. plicata*.

Summary & Future work

Effects on stream bed morphology:

- Higher mussel densities have greater effect
- Shell shape affects flow blockage

Future work:

- Analyze mussel protrusion data
- Test affect of mussel orientation
- Determine bedform migration rate and size

These results indicate a relationship between mussel density and stream bed stability, with increased mussel density better habitat for mussels and other organisms could develop.

Acknowledgments

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